

CLAIMS:

1. A nucleic acid sequence encoding an insecticidal Cry2Ae protein comprising: a) the amino acid sequence of the protein encoded by the *cry2Ae* gene deposited at the BCCM-LMBP under accession number LMBP 4248 or an insecticidal portion thereof, b) the amino acid sequence of the protein of SEQ ID No. 2 or an insecticidal portion thereof, c) the amino acid sequence of the protein of SEQ ID No. 2 from amino acid position 1 to amino acid position 625, or d) the amino acid sequence of an insecticidal protein encoded by a DNA hybridizing to the *cry2Ae* coding sequence deposited at the BCCM-LMBP under accession number LMBP 4248 under stringent hybridization conditions, wherein said DNA has a sequence identity of at least 93% to the coding sequence of SEQ ID No 1.

2. The nucleic acid sequence encoding the protein comprising the amino acid sequence of part d) of Claim 1, wherein said nucleic acid has a sequence identity of at least 98% to the coding sequence of SEQ ID No. 1.

3. The nucleic acid sequence encoding the protein comprising the amino acid sequence of part d) of Claim 2, wherein said nucleic acid has a sequence identity of at least 99% to the coding sequence of SEQ ID No. 1.

4. A nucleic acid sequence encoding a protein comprising: a) the amino acid sequence of the protein encoded by the *cry2Af* gene deposited at the BCCM-LMBP under accession number LMBP 4247 or an insecticidal portion thereof, b) the amino acid sequence of the protein of SEQ ID No. 4 or an insecticidal fragment thereof, c) the amino acid sequence of SEQ ID No. 4 from amino acid position 1 to amino acid position 625, or d) the amino acid sequence of an insecticidal protein encoded by a DNA hybridizing to the *cry2Af* coding sequence deposited at the BCCM-LMBP under accession number LMBP 4247 under stringent hybridization conditions, wherein said DNA has a sequence identity of at least 95 % to the coding sequence of SEQ ID No. 3.

5. The nucleic acid sequence encoding the protein comprising the amino acid sequence of part d) of Claim 4, wherein said nucleic acid has a sequence identity of at least 98 % to the coding sequence of SEQ ID No. 3.

6. The nucleic acid sequence encoding the protein comprising the amino acid sequence of part d) of Claim 5, wherein said nucleic acid has a sequence identity of at least 99% to the coding sequence of SEQ ID No. 3.

7. A nucleic acid sequence encoding a protein comprising : a) the amino acid sequence of the protein encoded by the *cry2Ag* gene deposited at the BCCM-LMBP under accession number LMBP 4249 or an insecticidal portion thereof, b) the amino acid sequence of the protein of SEQ ID No. 6 or an insecticidal fragment thereof, c) the amino acid sequence of the protein of SEQ ID No. 6 from amino acid position 1 to amino acid position 620, or d) the amino acid sequence of an insecticidal protein encoded by a DNA hybridizing to the *cry2Ag* coding sequence deposited at the BCCM-LMBP under accession number LMBP 4249 under stringent hybridization conditions, wherein said DNA has a sequence identity of at least 95 % to the coding sequence of SEQ ID No. 5.

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8. The nucleic acid sequence encoding the protein comprising the amino acid sequence of part d) of Claim 7, wherein said nucleic acid has a sequence identity of at least 98 % to the coding sequence of SEQ ID No. 5.

9. The nucleic acid sequence encoding the protein comprising the amino acid sequence of part d) of Claim 8, wherein said nucleic acid has a sequence identity of at least 99 % to the coding sequence of SEQ ID No. 5.

10. The nucleic acid sequence of any one of claim 1, 4 or 7, wherein said nucleic acid sequence is DNA.

11. The nucleic acid sequence of claim 10, comprising an artificial DNA sequence having a different codon usage compared to the naturally occurring DNA sequence but encoding the same protein or its insecticidal fragment.

5 12. The nucleic acid sequence of claim 11 which is the DNA sequence of SEQ ID No. 7 or 9.

13. A protein comprising: a) the amino acid sequence of the protein encoded by the *cry2Ae* gene deposited at the BCCM-LMBP under accession number LMBP 4248 or an insecticidal portion thereof, b) the amino acid sequence of the protein of SEQ ID No. 2 or an insecticidal portion thereof, c) the amino acid of SEQ ID No. 2 from amino acid position 1 to amino acid position 625, or d) the amino acid sequence of an insecticidal protein encoded by a DNA hybridizing to the *cry2Ae* coding sequence deposited at the BCCM-LMBP under accession number LMBP 4248 under stringent hybridization conditions, wherein said protein has a sequence identity of at least 92 % to the protein of SEQ ID No. 2.

14. The protein comprising the amino acid sequence according to part d) of Claim 13, wherein said protein has a sequence identity of at least 98% to the protein of SEQ ID No. 2. *a*

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15. The protein comprising the amino acid sequence according to part d) of Claim 14, wherein said protein has a sequence identity of at least 99% to the protein of SEQ ID No. 2.

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16. A protein comprising: a) the amino acid sequence of the protein encoded by the *cry2Af* gene deposited at the BCCM-LMBP under accession number LMBP 4247, b) the amino acid sequence of the protein of SEQ ID No. 4 or an insecticidal portion thereof, c) the amino acid of SEQ ID No. 4 from amino acid position 1 to amino acid position 625, or d) the amino acid sequence of an insecticidal protein encoded by a DNA hybridizing to the *cry2Af* coding sequence deposited at the BCCM-LMBP under

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accession number LMBP 4247 wherein said protein has a sequence identity of at least 95 % to the protein of SEQ ID No. 4.

17. The protein comprising the amino acid sequence of part d) of Claim 16, wherein
5 said protein has a sequence identity of at least 98 % to the protein of SEQ ID No. 4.

18. The protein comprising the amino acid sequence of part d) of Claim 17, wherein
said protein has a sequence identity of at least 99 % to the protein of SEQ ID. No. 4.

10 19. A protein comprising a) the amino acid sequence of the protein encoded by the
cry2Ag gene deposited at the BCCM-LMBP under accession number LMBP 4249 or
an insecticidal portion thereof, b) the amino acid sequence of the protein of SEQ ID
No. 6 or an insecticidal portion thereof, c) the amino acid sequence of the protein of
15 SEQ ID No. 6 from amino acid position 1 to amino acid position 620, or d) the amino
acid sequence of an insecticidal protein encoded by a DNA hybridizing to the *cry2Ag*
coding sequence deposited at the BCCM-LMBP under accession number LMBP
4249 under stringent hybridization conditions wherein said protein has a sequence
identity of at least 95 % to the protein of SEQ ID No: 6.

20 20. The protein comprising the amino acid sequence of part d) of Claim 19, wherein
said protein has a sequence identity of at least 98 % to the protein of SEQ ID No: 6.

21. The protein comprising the amino acid sequence of part d) of Claim 20, wherein
said protein has a sequence identity of at least 99 % to the protein of SEQ ID No. 6.

25 22. A chimeric gene comprising the nucleic acid sequence of claim 10, under the
control of a plant-expressible promoter.

30 23. A chimeric gene comprising the nucleic acid sequence of claim 11, under the
control of a plant-expressible promoter.

24. A chimeric gene comprising the nucleic acid sequence of claim 12, under the control of a plant expressible promoter.

25. The chimeric gene of claim 22 which further comprises a DNA encoding a targeting or transit peptide for targeting to the vacuole, mitochondrion, chloroplast, plastid, or for secretion.

26. The chimeric gene of claim 23 which further comprises a DNA encoding a targeting or transit peptide for targeting to the vacuole, mitochondrion, chloroplast, plastid, or for secretion.

27. The chimeric gene of claim 24 which further comprises a DNA encoding a targeting or transit peptide for targeting to the vacuole, mitochondrion, chloroplast, plastid, or for secretion.

28. Plant cells, plants or seeds transformed to comprise the chimeric gene of claim 22.

29. Plant cells, plants or seeds transformed to comprise the chimeric gene of claim 23.

30. Plant cells, plants or seeds transformed to comprise the chimeric gene of claim 24.

31. Plant cells, plants or seeds transformed to comprise the chimeric gene of claim 25.

32. Plant cells, plants or seeds transformed to comprise the chimeric gene of claim 26.

33. Plant cells, plants or seeds transformed to comprise the chimeric gene of claim 27.

34. The plant cells, plants or seeds of claim 28, comprising: corn, cotton, rice, tobacco, oilseed rape, Brassica species, eggplant, soybean, potato, sunflower, tomato, sugarcane, tea, beans, tobacco, strawberry, clover, cucumber, watermelon, pepper, oat, barley, wheat, dahlia, gladiolus, chrysanthemum, sugarbeet, sorghum, alfalfa, or peanut.

35. The plant cells, plants or seeds of claim 29, comprising: corn, cotton, rice, tobacco, oilseed rape, Brassica species, eggplant, soybean, potato, sunflower, tomato, sugarcane, tea, beans, tobacco, strawberry, clover, cucumber, watermelon, pepper, oat, barley, wheat, dahlia, gladiolus, chrysanthemum, sugarbeet, sorghum, alfalfa, or peanut.

36. The plant cells, plants or seeds of claim 30, comprising : corn, cotton, rice, tobacco, oilseed rape, Brassica species, eggplant, soybean, potato, sunflower, tomato, sugarcane, tea, beans, tobacco, strawberry, clover, cucumber, watermelon, pepper, oat, barley, wheat, dahlia, gladiolus, chrysanthemum, sugarbeet, sorghum, alfalfa, or peanut plant cells, plants or seeds. *A*

37. The plant cells, plants or seeds of claim 31, comprising : corn, cotton, rice, tobacco, oilseed rape, Brassica species, eggplant, soybean, potato, sunflower, tomato, sugarcane, tea, beans, tobacco, strawberry, clover, cucumber, watermelon, pepper, oat, barley, wheat, dahlia, gladiolus, chrysanthemum, sugarbeet, sorghum, alfalfa, or peanut plant cells, plants or seeds.

38. The plant cells, plants or seeds of claim 32, comprising : corn, cotton, rice, tobacco, oilseed rape, Brassica species, eggplant, soybean, potato, sunflower, tomato, sugarcane, tea, beans, tobacco, strawberry, clover, cucumber, watermelon, pepper, oat, barley, wheat, dahlia, gladiolus, chrysanthemum, sugarbeet, sorghum, alfalfa, or peanut plant cells, plants or seeds.

39. The plant cells, plants or seeds of claim 33, comprising : corn, cotton, rice, tobacco, oilseed rape, Brassica species, eggplant, soybean, potato, sunflower, tomato, sugarcane, tea, beans, tobacco, strawberry, clover, cucumber, watermelon, pepper, oat, barley, wheat, dahlia, gladiolus, chrysanthemum, sugarbeet, sorghum, alfalfa, or peanut plant cells, plants or seeds.

40. A micro-organism, transformed to comprise the nucleic acid sequence of any one of claims 1, 4, or 7.

41. A micro-organism, transformed to comprise the nucleic acid sequence of claim 10.

42. A micro-organism, transformed to comprise the nucleic acid sequence of claim 11.

43. A micro-organism, transformed to comprise the nucleic acid sequence of claim 12.

44. A process for rendering a plant resistant to an insect, comprising transforming plant cells with the chimeric gene of claim 22, and regenerating transformed plants from such cells which are resistant to insects.

45. A process for rendering a plant resistant to an insect, comprising transforming plant cells with the chimeric gene of claim 23, and regenerating transformed plants from such cells which are resistant to insects.

46. A process for rendering a plant resistant to an insect, comprising transforming plant cells with the chimeric gene of claim 24, and regenerating transformed plants from such cells which are resistant to insects.

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47. A process for rendering a plant resistant to an insect, comprising transforming plant cells with the chimeric gene of claim 25, and regenerating transformed plants from such cells which are resistant to insects.

5 48. A process for rendering a plant resistant to an insect, comprising transforming plant cells with the chimeric gene of claim 26, and regenerating transformed plants from such cells which are resistant to insects.

10 49. A process for rendering a plant resistant to an insect, comprising transforming plant cells with the chimeric gene of claim 27, and regenerating transformed plants from such cells which are resistant to insects.

15 50. The process of claim 44 , wherein said insect is: *Heliothis virescens*, *Helicoverpa zea*, *Helicoverpa armigera*, *Anticarsia gemmatilis* and *Ostrinia nubilalis*, *Chilo suppressalis*, *Chilo partellus*, *Scirpophaga incertulas*, *Sesamia inferens*, *Cnaphalocrocis medinalis*, *Marasmia patnalis*, *Marasmia exigua*, *Marasmia ruralis*, or *Scirpophaga innotata*.

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20 51. The process of claim 45, wherein said insect is: *Heliothis virescens*, *Helicoverpa zea*, *Helicoverpa armigera*, *Anticarsia gemmatilis* and *Ostrinia nubilalis*, *Chilo suppressalis*, *Chilo partellus*, *Scirpophaga incertulas*, *Sesamia inferens*, *Cnaphalocrocis medinalis*, *Marasmia patnalis*, *Marasmia exigua*, *Marasmia ruralis*, or *Scirpophaga innotata*.

25 52. The process of claim 46, wherein said insect is: *Heliothis virescens*, *Helicoverpa zea*, *Helicoverpa armigera*, *Anticarsia gemmatilis* and *Ostrinia nubilalis*, *Chilo suppressalis*, *Chilo partellus*, *Scirpophaga incertulas*, *Sesamia inferens*, *Cnaphalocrocis medinalis*, *Marasmia patnalis*, *Marasmia exigua*, *Marasmia ruralis*, or *Scirpophaga innotata*.

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53. The process of claim 47, wherein said insect is: *Heliothis virescens*, *Helicoverpa zea*, *Helicoverpa armigera*, *Anticarsia gemmatilis* and *Ostrinia nubilalis*, *Chilo*

suppressalis, Chilo partellus, Scirpophaga incertulas, Sesamia inferens, Cnaphalocrocis medinalis, Marasmia patnalis, Marasmia exigua, Marasmia ruralis, or Scirpophaga innotata.

5 54. The process of claim 48, wherein said insect is: Heliothis virescens, Helicoverpa zea, Helicoverpa armigera, Anticarsia gemmatilis and Ostrinia nubilalis, Chilo suppressalis, Chilo partellus, Scirpophaga incertulas, Sesamia inferens, Cnaphalocrocis medinalis, Marasmia patnalis, Marasmia exigua, Marasmia ruralis, or Scirpophaga innotata.

10 55. The process of claim 49, wherein said insect is: Heliothis virescens, Helicoverpa zea, Helicoverpa armigera, Anticarsia gemmatilis and Ostrinia nubilalis, Chilo suppressalis, Chilo partellus, Scirpophaga incertulas, Sesamia inferens, Cnaphalocrocis medinalis, Marasmia patnalis, Marasmia exigua, Marasmia ruralis, or Scirpophaga innotata.

15 56. A method for controlling insects comprising expressing in transformed plant cells an insecticidally effective amount of the protein of any one of claims 13, 16 or 19 to control : Heliothis virescens, Helicoverpa zea, Helicoverpa armigera, Anticarsia
20 gemmatilis and Ostrinia nubilalis, Chilo suppressalis, Chilo partellus, Scirpophaga incertulas, Sesamia inferens, Cnaphalocrocis medinalis, Marasmia patnalis, Marasmia exigua, Marasmia ruralis, or Scirpophaga innotata.

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